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DEC 5 1994
LETTER OF TRANSMITTAL

Tel. (603) 431-4899 Fax (603) 431-5982

TO Charles Schwer
VT ANR
Dept of Conservation
Haz. Mat. Management Division

DATE	12/1/94	JOB NO.	Swanton RI
ATTENTION			
RE: Swanton Vermont Redevelopment of Ammunition Plant.			

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

- ☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ Report

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1	Oct 94		Remedial Investigation of the former Robin Hood Ammunition Plant Swanton, Vermont.

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REMARKS Thank you for your attention to this report.
As I told you over the phone the Town is trying to put in for a grant to redevelop this site with a submitted date of December 14th. They are hoping to get some feedback on cleanup goals and future requirements for any additional investigation.

I will call on Monday December 5th to answer questions and hopefully we can try to meet on the 9th.

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**REMEDIAL INVESTIGATION OF
THE FORMER ROBIN HOOD AMMUNITION PLANT
SWANTON, VERMONT**

Prepared for

Town of Swanton

Prepared by

**CASWELL, EICHLER & HILL, INC.
West Topsham, Vermont
Augusta, Maine
Portsmouth, New Hampshire
Parsippany, New Jersey**

October 1994

**REMEDIAL INVESTIGATION OF
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SWANTON, VERMONT**

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**REMEDIAL INVESTIGATION OF
THE FORMER ROBIN HOOD AMMUNITION PLANT
SWANTON, VERMONT**

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**REMEDIAL INVESTIGATION OF
THE FORMER ROBIN HOOD AMMUNITION PLANT
SWANTON, VERMONT**

1.0 INTRODUCTION

1.1 Purpose and Scope

In January 1994, Caswell, Eichler & Hill, Inc. (CEH) completed an Environmental Site Assessment (ESA) of the former Robin Hood Ammunition Plant (RHA) for the Swanton Board of Selectmen. The goal of the study was to provide information on the potential for oil or hazardous materials to exist at the site. Results of the ESA were used to determine the potential for redevelopment of the site and are presented in our report entitled "Environmental Site Assessment for the Former Robin Hood Ammunition Plant, Swanton, Vermont," January 1994. The assessment identified potential sources of contamination at the site including:

- septic tank sludge contaminated with Poly Aromatic Hydrocarbonss (PAHs) and Volatile Organic Compounds (VOCs),
- potential for high concentrations of lead and mercury in surface soils,
- a burn area used to incinerate off-spec ammunition that also contained high concentrations of lead and mercury,
- asbestos, and
- lead paint and/or dust in the buildings from previous industrial use.

The ESA report recommended additional work to quantify the extent of the contamination. This additional Remedial Investigation (RI) report was performed from August 17 to September 15, 1994. The RI included:

- surficial soil sampling for lead analysis,
- sampling of sludge from the septic tank for waste characterization of metal content and their potential for leaching,
- test pitting and monitoring well installation,
- water level measurement,
- water quality sampling and analysis for lead and volatile organic compounds.

Based on the limited budget for this phase of the RI, soil samples were not tested for mercury, and paint and dust samples were not tested for lead and mercury. Additionally, no asbestos sampling was completed.

1.2 General Setting

The subject site is accessed from Fourth Street in the Town of Swanton. Its location is shown on Figure 1 just west of I-89 and northwest of the Missisquoi River. The property's location may also be noted in Swanton tax assessor's records as Tax Map 37 in Book IV.

The focus of this RI was that portion of the site comprising approximately seven acres noted on Figure 1 as the "central development site". The central development site includes the buildings associated with the former Robin Hood Ammunition Company. The site is bounded to the north and east by the Lamoille Valley Railway, to the south by a future town recreation field, and to the west by the Swanton Elementary School. The site layout is shown on Figure 2. Of the existing eight structures, the major buildings of interest for redevelopment are the Main Ammunition Building, Power House, Nail Building, and Main Office.

1.3 Background

The site was first developed in 1909 when the Robin Hood Ammunition Company (RHA) expanded its operations and moved from the center of Swanton to the location under investigation. From 1909 until 1915, the RHA manufactured powder and ammunition. In 1915, the business was bought out by the Remington-Union Metallic Cartridge Company and was renamed the UMC Swanton Works until closing in 1919. In 1927 the plant was sold to Frank Cadorette, a local hotel operator. The plant was sold again in 1937 to the Central Vermont Railroad which used it for storage. George Yett purchased the property in 1945 for use as a manufacturing facility for burlap feed bags (United Bag Supply). The property was next sold to Edward Bayer in 1973, who reportedly manufactured polypropylene feed bags as well as selling melting salts. The property was sold to the current owner, the Swanton School District on May 19, 1989. A portion of the site that had previously held smaller temporary buildings and the rifle range was developed into the new elementary school.

In addition to the owners of the site, discussions with local residents revealed that there were other tenants of the plant buildings including a cedar fence manufacturer (Power House) and a maker of tire chains. The location of the former tire chain facility is the "Chain Building Slab" shown in Figure 2.

2.0 DESCRIPTION OF WORK PERFORMED

The description of work performed presented below follows the order of the tasks listed in the scope of work proposal dated June 23, 1994 submitted by Mr. David Brooks of CEH to Mr. Earl Fournier Chairman of the Selectboard for the Town of Swanton.

2.1 Sampling and Analysis of Septic Tank Sludge

A sample of sludge was collected from the septic tank located near the Chain Building Slab and formerly used by that manufacturing facility.. The purpose of the sample was to determine the metals content of the sludge and the most cost effective and technically feasible method for disposal. The Vermont Department of Conservation (VTDEC) requested the sample to determine if the sludge has the potential to leach heavy metals. The ability of the sludge to leach heavy metals above regulatory limits would cause it to be considered a hazardous waste. If classified as a hazardous waste, disposal could not be done at a local municipal sewage treatment plant. Other available options could be on-site landfarming or offsite disposal.

The sludge was sampled by CEH on August 17, 1994. To collect the sample, the top of the tank was exposed by the Swanton Department of Public Works backhoe. A clear plastic tube was lowered through an opening in the top of the tank and inserted into the sludge layer. Liquid was decanted from the tube and the sludge was transferred to a polyethylene sample container.

The sample was stored at four degrees centigrade in a cooler and shipped via Federal Express to IEA in North Billerica, Massachusetts where it was analyzed for zinc, mercury, cadmium, chromium, copper, nickel, lead, and total solids. Sample results are discussed in Section 3.1.

2.2 Chain Building Leach Field Screening

On August 17, 1994 seven test pits were dug in the area of the Chain Building Slab septic tank leaching field at locations shown on Figure 3. Water samples were collected from the test pits and screened with an on-site portable gas chromatograph. The purpose of this test pitting and sampling program was to determine the size of the leaching field, to ascertain the extent of suspected hydrocarbon contamination released into the leaching field from the facility while it was operating, and to provide a basis for the location of a monitoring well to better characterize the nature of the suspected contamination.

The test pitting program was conducted with the Swanton Department of Public Works backhoe and overseen by a CEH geologist/site evaluator. The test pits were excavated to the water table. Test pit logs are included in Appendix A.

A groundwater sample was collected from each of the seven test pits by dipping a polyethylene bailer into the water in the test pit. The headspace of the samples was

screened with a Photovac Model 10S50 portable gas chromatograph (GC) for toluene and xylenes (two volatile organic compounds previously identified in the septic tank sludge).

Approximately 20 ml of water was placed in a 40 ml VOA vial with a teflon-coated silicone septum. The sample was shaken then allowed to equilibrate at approximately 75 degrees Fahrenheit for 15 minutes; the equilibration time allowed the VOCs to volatilize from the liquid phase into the gaseous phase in the headspace of the vial. A sample of the air was then extracted from the vial and injected into the gas chromatograph (GC). Based on the retention time of VOCs in the GC's isothermal column, the compound can be identified by comparison to the standards of toluene and xylene. Aqueous headspace standards were prepared by mixing a known volume of pure toluene and xylene with a known volume of water. The concentrations of the standard used for comparison was 67 parts per billion (mg/l) toluene and 67 mg/l of o-xylene.

2.3 Test Pit Monitoring Well Installation

Nine monitoring wells were installed in test pits at the locations depicted on Figure 2. The test pits were dug to characterize the near-surface geology and facilitate installation of the wells. The wells were installed to allow the collection of groundwater samples and the determination of groundwater flow directions.

The wells were installed on August 17-18, 1994 under the supervision of a CEH geologist. The test pits were dug to between six and eight feet by the Town of Swanton, DPW backhoe. The wells were constructed with flush-joint, two inch diameter screens and risers. The top of the casings were secured with locking expansion-type top caps. The screens were each five feet long with screen slots 0.010 inches wide (10-slot). The bottom of each screen was covered with a PVC slip-on bottom cap. The native sandy soil was returned to the pits and used as backfill around the wells.

After the water level in the wells had stabilized, the depth to the water table was measured, dedicated Waterra sampling equipment was installed, and the wells were developed by pumping three to five volumes of water.

2.4 Location of Suspected Gasoline Tank

On August 18, 1994, an attempt was made to locate a 125-gallon gasoline underground storage tank (UST) noted on a Sanborn's Fire Insurance map from 1920. The UST was reportedly located at the northwest corner of a wood frame, one-story storage building to the north of the power plant building. A metal detector survey was conducted and four trenches were dug with the Swanton DPW backhoe in order to locate the tank and/or any gasoline released to the environment.

2.5 Soil Sampling and Analysis

A soil sampling and analysis program was conducted at the site to determine the spatial distribution of lead in surficial soil. Eighty-seven soil samples were collected within the central development boundary. Samples were taken at 50 foot intervals across the developed area and at 100 foot intervals within the wooded portions of the site. The top six inches of the soil was tested. In a disturbed area half surrounded by a berm, (located in the northeast corner of the site), samples were also taken at 2, 3 and 3.5 feet below the ground surface (bgs).

Most of the soil sampling was completed on August 17 and 18, 1994. Four additional samples were collected on September 15, 1994 to better define the boundaries of the contamination detected. To collect the samples, a grid was staked out and soil was excavated with either a hand auger or the DPW backhoe. Test pits were terminated in natural soil or at a minimum depth of two feet bgs. Hand auger borings were terminated at two feet bgs or refusal. Sample depths are listed in Table III.

Samples were collected in four ounce glass jars, stored at four degrees centigrade and shipped in a cooler via Federal Express to IEA Laboratories in North Billerica, Massachusetts for analysis of lead.

2.6 Monitoring Well Sampling

Groundwater samples were collected on September 14 and 15, 1994 from the nine wells at the site. Sampling was conducted to determine the concentrations of lead in groundwater and to determine if VOC contamination in the area of the Chain Building septic system or the reported 125-gallon gasoline UST existed. To accomplish this, samples from all nine wells were tested for dissolved lead and field parameters including pH, conductivity, and temperature. Samples from two wells, MW-5 located at the Chain Building leach field and MW-8 located in the reported gasoline UST area were also tested for VOCs according to USEPA Method 624.

Samples were collected with the pre-installed individually dedicated Waterra sampling equipment. Waterra samplers were used to minimize the possibility of cross contamination caused by transferring sampling equipment from well to well. Prior to sampling each well, the static water level was determined with a Solinst electronic water level indicator and the well was purged of three well volumes or until it was dry whichever occurred first. During purging, the same field parameters as referenced above were monitored. Final field parameters are reported in Table IV.

The samples for dissolved lead were collected in laboratory supplied, polyethylene containers pre-preserved with nitric acid. These samples were filtered with an in-line Waterra Model FHT-700 disposable 0.45 micron filters to remove suspended material. To avoid cross contamination, a new filter was used for each sample. The samples for VOCs were collected in laboratory supplied 40 ml glass containers pre-preserved with

hydrochloric acid. The samples were stored on ice in a cooler and shipped via Federal Express to IEA in North Billerica, Massachusetts for analysis. Analytical results are discussed in Section 3.7.

Concurrent with sampling, CEH determined the approximate position of the wells relative to the soil sampling grid. The elevation of the monitoring wells was determined with a survey level using an assumed benchmark elevation of 155 feet at the northwest corner of the Chain Building Slab. The survey loop was closed to within 0.1 feet. The surveyed elevations of the tops of the PVC well casings are summarized in Table I.

Table I. Well Construction and Groundwater Elevations

	Top of	Ground	Well	Well		
	PVC Casing	Surface	Depth	Screen	Water Elevations	
Well	Elevation	Elevation	(feet bgs)	Elevation	8/18/94	9/14/94
MW-1	155.01	153.9	8	144.8 - 149.8	149.64	149.49
MW-2	154.26	153.3	7.4	144.9 - 149.9	150.44	150.24
MW-3	151.64	150.6	6.1	143.8 - 148.8	152.81	152.39
MW-4	153.88	152.4	8.1	142.8 - 147.8	150.09	149.89
MW-5	155.78	154.8	8.3	145.5 - 150.5	148.11	147.99
MW-6	155.74	154.3	8.3	144.6 - 149.6	147.91	147.71
MW-7	155.49	154.4	7.5	145.9 - 150.9	149.11	148.85
MW-8	154.06	153.1	7.2	144.9 - 149.9	150.21	150.07
MW-9	153.17	152.8	7.7	144.7 - 149.7	150.54	150.43

Notes:

1. Elevations are measured in feet relative to the top of the Chain Building Slab which was assumed to be at an elevation of 155.0 feet above Mean Sea Level based on the USGS 7.5 minute topographic map.

3.0 FINDINGS AND DISCUSSION

3.1 Chain Building Septic Tank Sludge

The Chain Building septic tank is located between the Chain Building Slab and the Power Plant Building as shown on Figure 3. It is approximately 12 feet long and seven feet wide and is constructed of concrete. It contains a layer of sludge approximately one foot deep with a layer of water one foot above the sludge. The total volume of the sludge and water is approximately 1500 gallons. The tank was connected to the chain factory by a building sewer pipe which appeared to extend from the northeast corner of the concrete slab to the northeast corner of the septic tank. This location matches with a rectangular hole in the building slab. No floor drains or holes were noted elsewhere in the Chain Building Slab.

Chemical analysis of the sludge sample collected on August 17, 1994 indicated that the sludge contained 5.7% solids and varying levels of metal ions. The results of the analysis are summarized in Table II.

CEH contacted Mr. Ernie Kelly of the VTDEC Residual Wastewater Bureau regarding the concentration of metals in the sludge. According to Mr. Kelly, due to the high concentration of lead (283 mg/kg) the sludge leachate will likely exceed the regulatory limit. Therefore, the sludge cannot be disposed of at a municipal wastewater treatment plant. The sludge will need to be handled as a hazardous waste.

Table II Septic Tank Sludge Sample Results

Parameter	Result	Units	Sampling Date
Zinc	7460	mg/kg (dry)	8/17/94
Mercury	0.37	mg/kg (dry)	8/17/94
Cadmium	23.9	mg/kg (dry)	8/17/94
Chromium	175	mg/kg (dry)	8/17/94
Copper	1440	mg/kg (dry)	8/17/94
Nickel	123	mg/kg (dry)	8/17/94
Lead	283	mg/kg (dry)	8/17/94
Total Solids	5.7	%	8/17/94
Toluene	30000	ug/kg	12/16/93
Acetone	LCB	ug/kg	12/16/93
Total Xylenes	880J	ug/kg	12/16/93
Total VOCs	30880	ug/kg	12/16/93
Napththalene	15000	ug/kg	12/16/93
Acenaphthylene	12000	ug/kg	12/16/93
Acenaphthene	20000	ug/kg	12/16/93
Florene	5800	ug/kg	12/16/93
Phenanthrene	7600	ug/kg	12/16/93
Anthracene	6200	ug/kg	12/16/93
Fluoranthene	2000	ug/kg	12/16/93
Pyrene	2100	ug/kg	12/16/93
Total PAHs	70700	ug/kg	12/16/93

Notes:

1. LCB denotes that the compound was found at low concentrations comparable to that in the blank. Quantitation was not possible.
2. J denotes that the mass spectrum indicates the presence of the compound, but the calculated result is less than the method specified reporting limit.
3. PAHs denote polyaromatic hydrocarbons.

3.2 Leaching Field

Effluent from the Chain Building septic tank was disposed to the subsurface soil through a leaching field located to the east of the tank. The field consisted of a perforated, four-inch diameter PVC pipe surrounded by $\frac{3}{4}$ inch gravel. The pipe was observed in two of the seven test pits dug in the area of the leaching field, ST-TP-3 and ST-TP-6. The approximate location of the disposal system is depicted on Figure 3. The top of the stone was approximately 2.5 feet below ground surface and 3.5 feet above the water table. The stone layer was approximately ten inches thick.

The headspace of one sample of water from the Chain Building septic tank and seven samples of groundwater from the leach field test pits were screened for toluene and o-xylenes. No indication of either compound was found from water in test pits ST-TP-1, 2, 3, or 4. Trace levels of toluene were noted in the septic tank water and test pits ST-TP-5 and 6, below 20 mg/l. Trace levels of xylenes were also noted in the septic tank water and test pits ST-TP-5, 6, and 7 below 20 mg/l.

Monitoring well MW-5 was installed in test pit ST-TP-6 which was directly below a leach field pipe. Laboratory samples for VOC's were collected to verify the field GC screening results. The groundwater sample from MW-5 was analyzed for lead and VOC's (according to USEPA Method 624). Test results are summarized in Table V. The VOC analysis did not reveal toluene or xylenes in the groundwater above the detection limit of five mg/l. However two other VOCs were detected. Acetone was found at a concentration of 580 ug/L which is below the VTDEC regulatory limit of 700 ug/L. A second VOC, 2-butanone (MEK) was detected at 200 ug/L in the sample. This concentration slightly exceeds the VTDEC limit of 170 ug/L for 2-butanone.

In a sludge sample tested during the previously completed Environmental Site Assessment, the concentration of MEK was below the detection limit of 2200 mg/l and acetone was noted in a trace amount.

3.3 Suspected Gasoline Tank

An approximately 400 square foot area was surveyed with a Schonstedt metal detector by CEH personnel. No anomalies indicative of a metallic UST were observed. Four backhoe trenches were then excavated. These trenches were each approximately 20 feet long by three feet wide by five feet deep (to the water table). No UST or piping was found. A monitoring well, MW-8, was subsequently installed in the area and later sampled for gasoline-related volatile organic compounds. Sampling methods are discussed in Section 2.6. No VOC's were detected in the groundwater at this location.

3.4 Site Geology

The overburden was mapped as Deerfield and Colton fine sandy loam. The soil observed in test pits was a fluvial deposit primarily consisting of fine sand and silty fine sand. Medium sand was observed under the fine sand at four locations in the area of the Chain

Building septic tank. Varying depths of fill were observed overlying the natural deposits in the test pits. No glacial till, glaciomarine clay, or bedrock was observed in the pits.

3.5 Site Hydrogeology

Groundwater was found in the wells between one and six feet below the ground surface. Ground water flow is generally to the northeast in the westerly portion of the site and to the south in the northeast portion of the site. Horizontal groundwater flow directions are depicted on Figure 4. Groundwater flow directions at the site may be influenced by an abandoned sewer line located to the east of the Main Munitions Building. This sewer may act as a groundwater sink providing an open conduit for subsurface flow to the brook\drainage to the east of the site (see Figure 1.).

3.6 Soil Quality Results

Lead concentrations measured in soil during August 1994 range from 0.79 mg/kg to 231,000 mg/kg (23%). In comparison, the background levels of Vermont soils of similar depth and type range from 6 to 31 mg/kg (FDA, 1982). Over 71 % of the site soils exceed the background level for lead. The concentration of lead in the soil within the Central Development Site is clearly elevated above normal, which is most likely due to the manufacturing of munitions. The lead in soil concentrations are found in Table III and Appendix C. The sample locations and concentrations are displayed on Figure 5.

The major threat to human health at this site is through ingestion of lead. Lead contained on soil particles or dust can be ingested through hand to mouth contact or to some extent by inhalation. The cleanup goal used during the 1991 study prior to school construction, was 300 mg/kg (a USEPA and VTDEC guideline). The Aquatec data from the 1991 investigation had two samples exceeding the cleanup goals. (390 and 69,000 mg/kg) These samples were located on the southwest side of the site (currently school property). Based on these findings, Dr. Bill Bress (VTDEC State Toxicologist), recommended that the soil in these areas be removed or capped prior to construction of the school. In addition, Dr. Bress also recommended that a new layer of soil be spread and seeded across all unpaved school areas. According to school district records, the 69,000 mg/kg location was covered by the school slab. The other hot spot was reportedly excavated and disposed of off-site.

On October 21, 1994 CEH contacted Dr. Bress by phone and confirmed that 300 mg/kg is still an acceptable cleanup goal for this site.

In order to evaluate the spatial distribution of lead in the soil, CEH used the kriging function of the graphing program Surfer Version 4.0 to interpret the contour for lead concentrations in soil greater than the cleanup goal of 300 mg/kg. The Surfer-interpreted results are illustrated in Appendix D. This plot was the basis for the determination of the 300 mg.kg contour used in delineating the areas of the site which exceed the cleanup goal. Figure 6, which denotes the four areas exceeding the cleanup goal within the Central

Development Area, isolates the 300 mg/kg contour over the site. Areas for the contaminated soils were calculated by the computer aided design (CAD) program Autocad Version 12.

CEH 1994 soils data for lead was compared to Aquatec data collected on August 9, 1991. This data comparison was done to provide a broader picture of the distribution of lead contamination in the soil outside the Central Development Area. The high hits of contamination found in 1991 (on what is now the current school property), do not correlate with any 1994 hot spots (>300 mg/kg). However, Aquatec samples from 1991 that were collected within the Central Development site boundaries correlated reasonably well with current CEH results.

Area 1, located in the northeast corner of the property, is believed to be the "burn area" where off-spec materials were disposed. The vegetation in this area is visibly stressed. In addition, shotgun casings (stamped with RHA and 12 gauge) were found at the ground surface. The highest concentrations of lead in soil found on the entire site to date were found in this area. Samples from grid location 100,150 and 150,150 contained 231,000 (23%) and 106,000 (10.6%) mg/kg respectively. A sample from the burn area was sieved and found to contain lead shot. Based on laboratory analytical data and the interpretation of the 300 mg/kg boundary, approximately 19,350 square feet of soil requires remediation at this location. Based on the hand augured boring in the burn area, the ash layer appears to extend approximately 1 foot bgs. However, visual appearance is not necessarily indicative of lead concentrations. Samples should be collected at depth and used to determine the vertical extent of contamination.

The bermed area (located at 25,25) that was first believed to be the burn area appeared to have a fill/ash layer up to 4 feet deep, however, samples collected at 0.5, 2.0, 3.0 and 3.5 feet below ground surface (bgs) were 62, 447, 78 and 32 mg/kg of lead respectively. In addition, no indication of shell casings or other munitions was found. While the soils at 3 feet are above the cleanup level the contamination is minor compared to the actual burn area and does not pose a hazard based on its depth below ground surface.

Area 2 is located on the north side of the Main Munitions Building. The maximum lead concentration in this area is 590 mg/kg. Based on laboratory analytical data and the interpretation of the 300 mg/kg boundary, approximately 2,550 square feet of soil requires remediation at this location.

Area 3 is an extensive area located between the south end of the Main Munitions Building and the Nail Building, and extends to the Class II wetland in the southwest corner of the property. The maximum value of lead in this area is 1,270 mg/kg at location 450,650. The spread of contamination in this area may be due to surface water runoff toward the drainage ditch in the southeast corner of the property. Transport of lead may be occurring as dissolved lead, particles of lead, or lead contaminated soil. Based on laboratory analytical data and the interpretation of the 300 mg/kg boundary, approximately 23,000 square feet of soil requires remediation at this location of which approximately 8,180

square feet is wetlands. Disturbance of the wetland by soils excavation will require permits. Remediation in this area could also require replacement of the wetlands with a manmade version. It should be noted that the drainage from the contaminated wetland crosses school property. Access to this drainage should be restricted and testing of sediment and surface water performed.

Area 4 is located adjacent the old rifle range and borders the school property. The extent of contaminated soils that may exist on the school property is not known. The fill that was to be placed at the site during construction should provide a barrier to exposure. In order to determine the extent of contamination in this area, samples should be taken on the school property within 50 feet of the nearest grid points. Samples should be collected at the ground surface and below the layer of fill. Based on laboratory analytical data and the interpretation of the 300 mg/kg boundary, approximately 16,100 square feet of soil requires remediation at this location.

Table III. Soil Quality Data

Sample Number	Grid Coordinates X,Y (feet, feet)	Depth (ft bgs)	Lead Concentration (mg/kg)	Sample Date
SS-0,0	0,0	0-0.5	59	8/17/94
SS-0,50	0,50	0-0.5	25	8/17/94
SS-0,100	0,100	0-0.5	38	8/17/94
SS-0,150	0,150	0-0.5	72	8/17/94
SS-0,200	0,200	0-0.5	20	8/17/94
SS-0,300	0,300	0-0.5	19	8/17/94
SS-0,400	0,400	0-0.5	12	8/18/94
SS-0,500	0,500	0-0.5	16	8/18/94
SS-0,600	0,600	0-0.5	47	8/18/94
SS-0,700	0,700	0-0.5	34	8/18/94
SS-25,25	25,25	0-0.5	62	8/18/94
SS-25,25	25,25	2	447	8/18/94
SS-25,25	25,25	3	78	8/18/94
SS-25,25	25,25	3.5	32	8/18/94
SS-50,0	50,0	0-0.5	33	8/17/94
SS-50,50	50,50	0-0.5	22	8/17/94
SS-50,100	50,100	0-0.5	21	8/17/94
SS-50,150	50,150	0-0.5	12.1	8/17/94
SS-50,200	50,200	0-0.5	56	8/17/94
SS-50,350	50,350	0-0.5	61	8/18/94
SS-100,0	100,0	0-0.5	47	8/17/94
SS-100,50	100,50	0-0.5	2850	8/17/94
SS-100,100	100,100	0-0.5	407	8/17/94
SS-100,150	100,150	0-0.5	231000	8/17/94
SS-100,200	100,200	0-0.5	214	8/17/94
SS-100,300	100,300	0-0.5	203	8/18/94
SS-100,400	100,400	0-0.5	44	8/18/94
SS-100,500	100,500	0-0.5	17.4	8/18/94
SS-100,600	100,600	0-0.5	13.5	8/18/94
SS-100,700	100,700	0-0.5	46	8/18/94
SS-100,800	100,800	0-0.5	36	8/18/94
SS-150,0	150,0	0-0.5	79	8/18/94
SS-150,50	150,50	0-0.5	144	8/17/94
SS-150,100	150,100	0-0.5	199	8/17/94
SS-150,150	150,150	0-0.5	106000	8/17/94
SS-150,200	150,200	0-0.5	245	8/17/94
SS-150,250	150,250	0-0.5	105	8/18/94
SS-150,350	150,350	0-0.5	14	8/18/94
SS-150,450	150,450	0-0.5	50	8/18/94
SS-150,550	150,550	0-0.5	231	8/18/94
SS-150,650	150,650	0-0.5	87	8/18/94
SS-200,50	200,50	0-0.5	84	9/15/94
SS-200,100	200,100	0-0.5	84	8/17/94
SS-200,150	200,150	0-0.5	3410	9/15/94
SS-200,200	200,200	0-0.5	27	8/17/94
SS-200,300	200,300	0-0.5	44	8/18/94
SS-200,500	200,500	0-0.5	87	8/18/94
SS-200,600	200,600	0-0.5	84	8/18/94
SS-200,700	200,700	0-0.5	89	8/18/94

Table III. Soil Quality Data

Sample Number	Grid Coordinates X,Y (feet, feet)	Depth (ft bgs)	Lead Concentration (mg/kg)	Sample Date
SS-200,760	200,760	0-0.5	52	8/18/94
SS-250,250	250,250	0-0.5	47	8/18/94
SS-250,550	250,550	0-0.5	72	8/18/94
SS-300,100	300,100	0-0.5	28	8/17/94
SS-300,200	300,200	0-0.5	22	8/17/94
SS-300,300	300,300	0-0.5	590	8/17/94
SS-300,400	300,400	0-0.5	234	8/18/94
SS-300,500	300,500	0-0.5	31	8/18/94
SS-300,700	300,700	0-0.5	38	8/18/94
SS-350,250	350,250	0-0.5	191	8/17/94
SS-350,450	350,450	0-0.5	319	8/18/94
SS-350,550	350,550	0-0.5	559	8/18/94
SS-350,650	350,650	0-0.5	309	8/18/94
SS-400,100	400,100	0-0.5	69	8/17/94
SS-400,200	400,200	0-0.5	22	8/17/94
SS-400,300	400,300	0-0.5	83	8/17/94
SS-400,400	400,400	0-0.5	65	8/18/94
SS-400,500	400,500	0-0.5	353	8/18/94
SS-400,600	400,600	0-0.5	111	8/18/94
SS-400,700	400,700	0-0.5	259	8/18/94
SS-400,785	400,785	0-0.5	25	8/18/94
SS-450,250	450,250	0-0.5	10	8/18/94
SS-450,350	450,350	0-0.5	13	8/18/94
SS-450,450	450,450	0-0.5	96	8/18/94
SS-450,650	450,650	0-0.5	1270	8/18/94
SS-500,100	500,100	0-0.5	35	8/17/94
SS-500,200	500,200	0-0.5	14	8/17/94
SS-500,300	500,300	0-0.5	0.79	8/18/94
SS-500,400	500,400	0-0.5	112	8/18/94
SS-500,500	500,500	0-0.5	60	8/18/94
SS-500,600	500,600	0-0.5	26	8/18/94
SS-500,700	500,700	0-0.5	471	8/18/94
SS-500,800	500,800	0-0.5	192	8/18/94
SS-550,250	550,250	0-0.5	16	8/18/94
SS-550,350	550,350	0-0.5	3045	8/18/94
SS-550,450	550,450	0-0.5	28	8/18/94
SS-550,650	550,650	0-0.5	139	9/15/94
SS-550,750	550,750	0-0.5	192	9/15/94
SS-600,100	600,100	0-0.5	30	8/17/94
SS-600,200	600,200	0-0.5	33	8/17/94
SS-700,100	700,100	0-0.5	16	8/17/94

3.7 Groundwater Quality Results

Groundwater sampling results are summarized in Tables IV and V. Laboratory reports are included in Appendix B. Field parameters were collected prior to sampling. Results of pH testing indicate that the groundwater is slightly acidic (5.6 to 6.7) and that conductivity's ranged from 0.113 mU/cm at MW-1 (which could be considered a background location at the site) to 0.788 mU/cm at MW-5 located at the Chain Building septic system which is also the area toward which groundwater at the site flows. This value reflects the discharge of conductive ions from the waste in the septic tank.

Table IV. Field Chemistry Data

Well	pH (SU)	Temperature (degrees C)	Conductivity mU/cm
MW-1	5.6	11.9	0.113
MW-2	6.3	15.3	0.588
MW-3	6.4	13.4	0.392
MW-4	5.9	12	0.312
MW-5	6.7	12	0.788
MW-6	6.3	14.1	0.352
MW-7	6.5	13.7	0.541
MW-8	6.1	12.1	0.196
MW-9	6.7	11.6	0.325

Notes:

1. Data collected September 14, 1994.
2. Conductivity values adjusted to 25 degrees C.

Results of analysis of the nine groundwater samples indicated that levels of lead were below the regulatory limit of 0.020 mg/L and the quantitation limit of 0.005 mg/L. The groundwater at MW-5 and MW-8 was also tested for the presence of volatile organic compounds according to USEPA Method 624. Analytical results for VOC's in MW-5, are discussed in Section 3.2. Analytical results for VOC's in the MW-8 sample are found in Section 3.3.

Table V. Groundwater Quality Data

	Sample Date	Lead	Acetone	2-Butanone
Units		(mg/L)	(ug/L)	(ug/L)
Regulatory Limit		0.02	700	170
Well				
MW-1	9/15/94	< 0.005	NS	NS
MW-2	9/14/94	< 0.005	NS	NS
MW-3	9/15/94	< 0.005	NS	NS
MW-4	9/15/94	< 0.005	NS	NS
MW-5	9/15/94	< 0.005	580	200
MW-6	9/14/94	< 0.005	NS	NS
MW-7	9/14/94	< 0.005	NS	NS
MW-8	9/15/94	< 0.005	< 100	< 100
MW-9	9/15/94	< 0.005	NS	NS
MW-19	9/15/94	< 0.005	NS	NS

Notes:

1. MW-19 is a field duplicate of MW-9.
2. NS denotes not sampled for volatile organic compounds.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Caswell, Eichler & Hill, Inc. completed a remedial investigation at the former Robin Hood Ammunition Site in Swanton, Vermont. In order to provide due diligence in connection with the redevelopment of the site and to reduce the risk to human health and the environment from contamination, we recommend the following actions:

1. Because the concentration of lead in the Chain Building septic tank sludge will likely exceed the leaching limit for lead, it cannot be disposed of at a municipal wastewater treatment plant. However, the sludge concentration is lower than the cleanup goal for contaminated soil at the site. Therefore on-site landfarming or off-site disposal are recommended.
2. The volatile organic compounds 2-Butanone and Acetone (common solvents) were identified in the groundwater under the Chain Building leachfield. It has not been determined whether PAH's may also contaminate the groundwater at this location. The level of Acetone at 580 ug/l is below the regulatory guidelines of 700 ug/l. 2-Butanone at 200 ug/L is slightly above the regulatory guideline of 200 ug/l. Since no homeowner wells are known to exist near the site, CEH recommends annual monitoring of the groundwater at MW-5 to confirm the concentrations of VOC's and to determine whether PAH's are present. The cessation of VOC monitoring should be based on a stable downward trend below the regulatory limits or in the case of PAH's no indication of contamination. Analysis at this location should be for VOC's by EPA Method 8240 and also at least one round of PAHs by EPA Method 8270.
3. No indication of an existing gasoline tank or an environmental impact was found in the area of MW-8. Based on the information obtained during the ESA and this RI, no further action is warranted for UST's at this site.
4. Because of the elevated levels of lead encountered in surficial soil and the hazards due to inadvertent ingestion or inhalation associated with this contamination, CEH recommends remediation of soil with a lead concentration which equals or exceeds 300 mg/kg. In order to determine the best technical and cost effective method for remediation, a feasibility study should be performed. Additional soil samples are required to refine the horizontal and vertical extent of the soils requiring cleanup. The thickness and vegetation of the soil cover at the school should be diligently maintained.
5. Groundwater apparently is not impacted by lead leaching from the soil. To verify this, we recommend the collection and analysis of a second round of water samples from the nine monitoring wells during a dry period when there is little or no recharge to the groundwater. The samples should be analyzed for dissolved lead and dissolved mercury.
6. It is unknown whether contamination exists in the drainage channel that historically received wastewater from the ammunition plant (the eastern drainage channel in Figure

1) or the drainage that currently receives runoff from the Class II lead contaminated wetland (southeastern drainage ditch). Surface water and sediment sampling should be performed in the drainage channels to the southeast and east of the site. The purpose of this sampling is to determine if offsite migration of lead or mercury has occurred via surface water, and whether or not a health risk exists. In the interim, access to the drainage channel at the school should be prevented.

7. The levels of lead dust or mercury vapor inside the former ammunition buildings is unknown. Prior to redeveloping the buildings, wipe samples for lead dust and measurements for mercury vapor should be collected. Based on the results of the sampling and the potential use of the buildings, remediation in the form of industrial cleaning may be necessary. Based on historical information regarding ammunition manufacturing locations, the most likely buildings impacted by lead or mercury would be the Nail Building and Main Munitions Building.
8. As a further precautionary measure to halt any offsite migration of contaminants, we recommend plugging the abandoned sewer line on the east side of the property with bentonite clay.
9. Removal of asbestos from all site buildings should then be performed.

5.0 REFERENCES

Aldighieri, Tracey; William Bentley; Caroline Gavin; Anita Gibeau; and Erik Hanson, "The Robin Hood / Remington Plant Re-Use Proposals".

Aquatec Letter Reports

10/6/89 to John Robb, Supt. of Schools, from Brett Cox

5/17/91 to Doug Harris, Supt. of Schools, from Robert J. Ross

5/21/91 to Doug Harris, Supt. of Schools, from Robert J. Ross

8/21/91 to Doug Harris, Supt. of Schools, from Brett Cox

9/16/91 to Doug Harris, Supt. of Schools, from Robert J. Ross

Caswell, Eichler & Hill, Inc., 1994, "Environmental Site Assessment for the Former Robin Hood Ammunition Plant, Swanton, Vermont, in "Redevelopment Services for Former Robin Hood Ammunition Co.

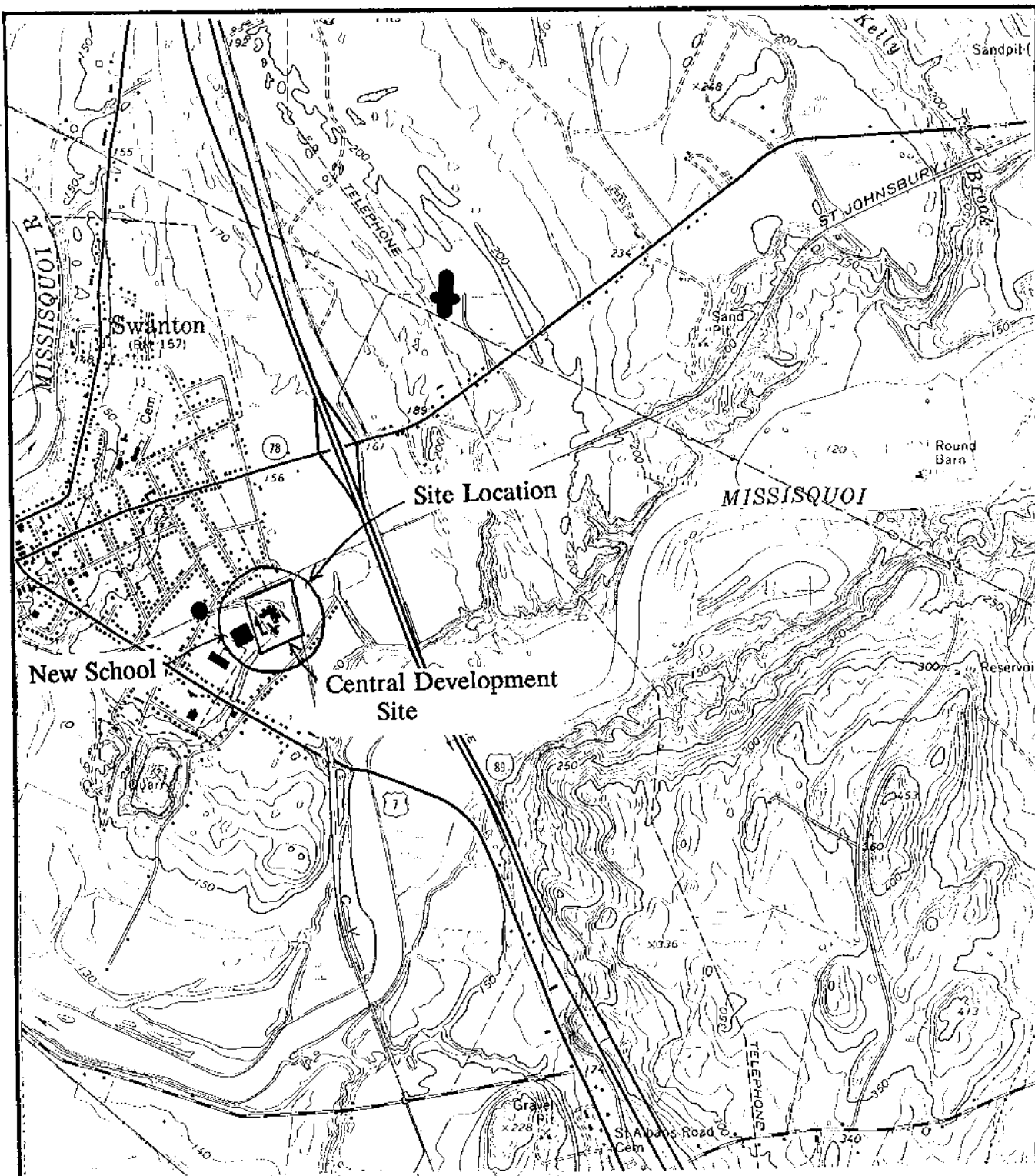
National Park Service, "U.S. Dept. of Interior National Register of Historic Places Registration Form", Draft Copy.

State of Vermont, Division of Historic Preservation, 1990, Historic Sites & Structures Survey Form.

U.S. Department of Agriculture, Soil Conservation Service, "Soil Survey of Franklin County, Vermont".

University of Vermont, Agricultural Experiment Station, 1982, Background Levels of Metals in Vermont Soils, Research Report 29.

Wiseman, Fred M., "Robin Hood Ammunition Co.," Rifle Magazine.



Source: Highgate Center, VT 7.5' USGS Quad. Map, 1964.

Caswell, Eichler & Hill, Inc.



CEH OFFICE: WEST TOPSHAM, VERMONT

DRAWING TITLE:

DATE PREPARED: 10-19-94
DESIGNED BY: GAP
DRAWN BY: GAP
CHECKED BY:
REVIEWED BY:

SITE LOCATION

REVISION DATE: REVISION NO: DRAWN BY: CHECKED BY: REVIEWED BY:

FILE NAME: SWANTON1.DWG

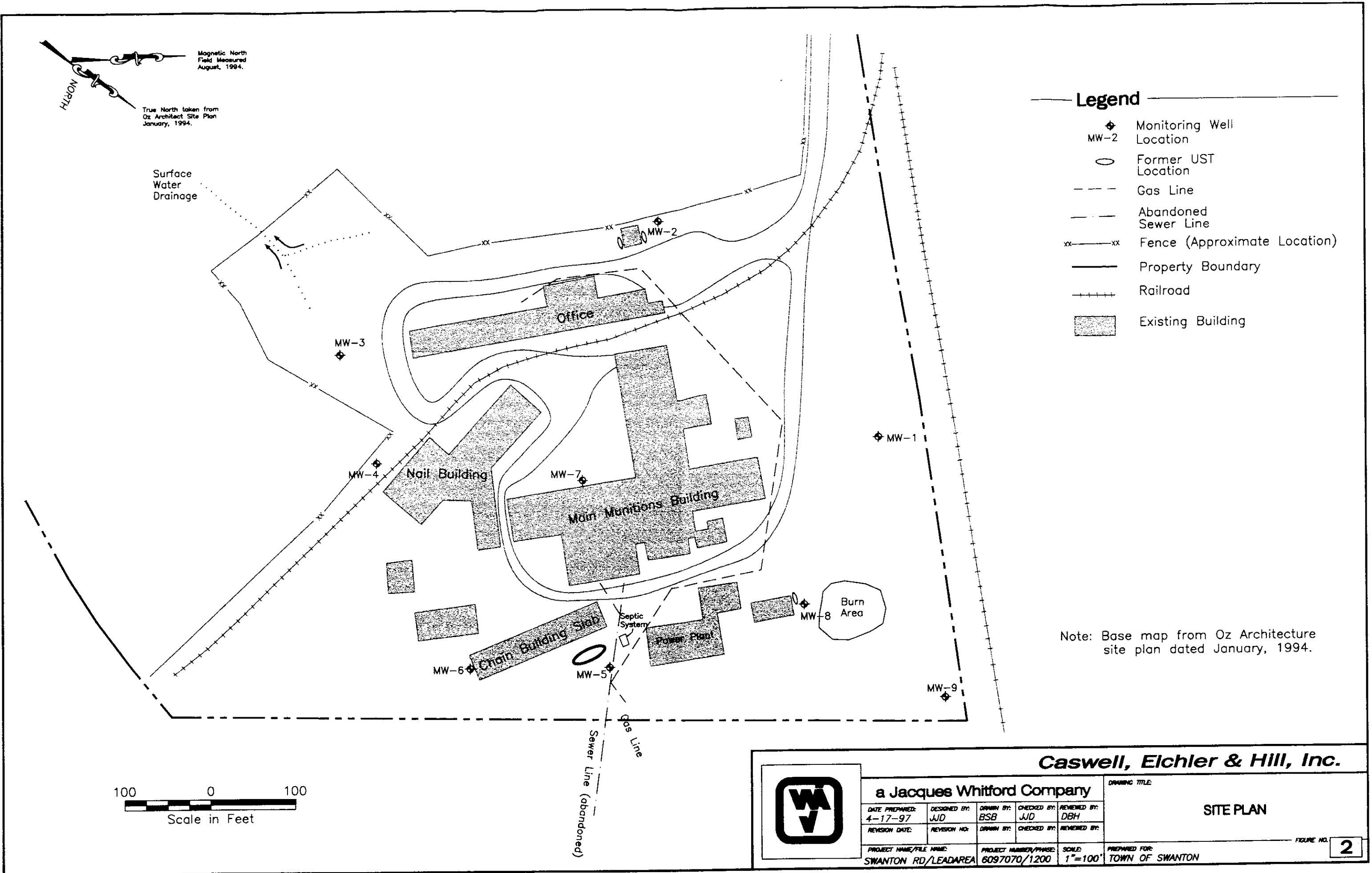
PROJECT NAME/NUMBER: SWANTON RI

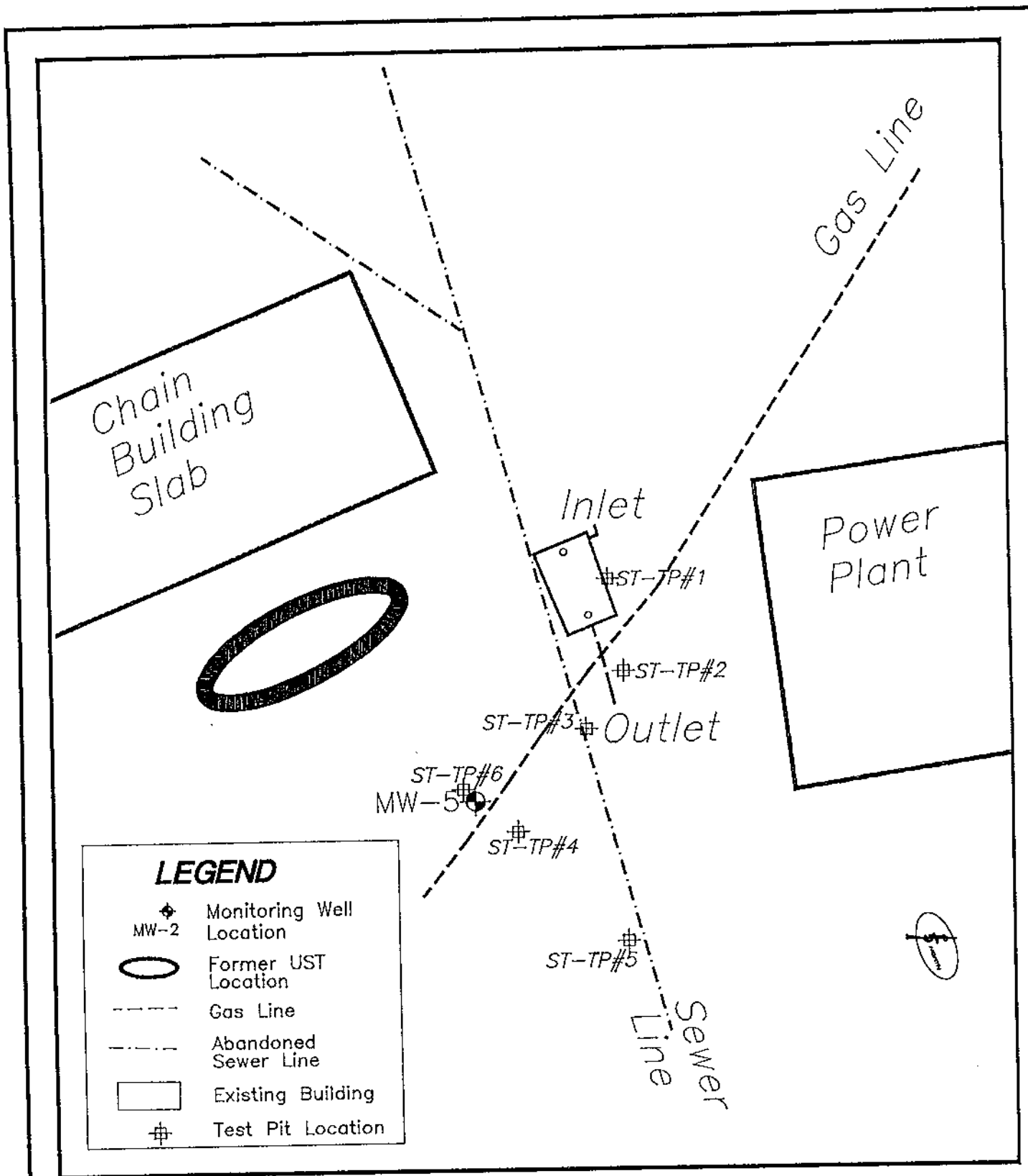
PREPARED FOR: TOWN OF SWANTON

DRAWING SCALE: 1:24000

FIGURE NO:

1





Caswell, Eichler & Hill, Inc.



CEH OFFICE: WEST TOPSHAM, VERMONT

DATE PREPARED: 10-21-94 DESIGNED BY: DVC DRAWN BY: GAP CHECKED BY: REVIEWED BY:

REVISION DATE: REVISION NO: DRAWN BY: CHECKED BY: REVIEWED BY:

FILE NAME: SEPTIC.DWG

PROJECT NAME/NUMBER: SWANTON RI

DRAWING TITLE:

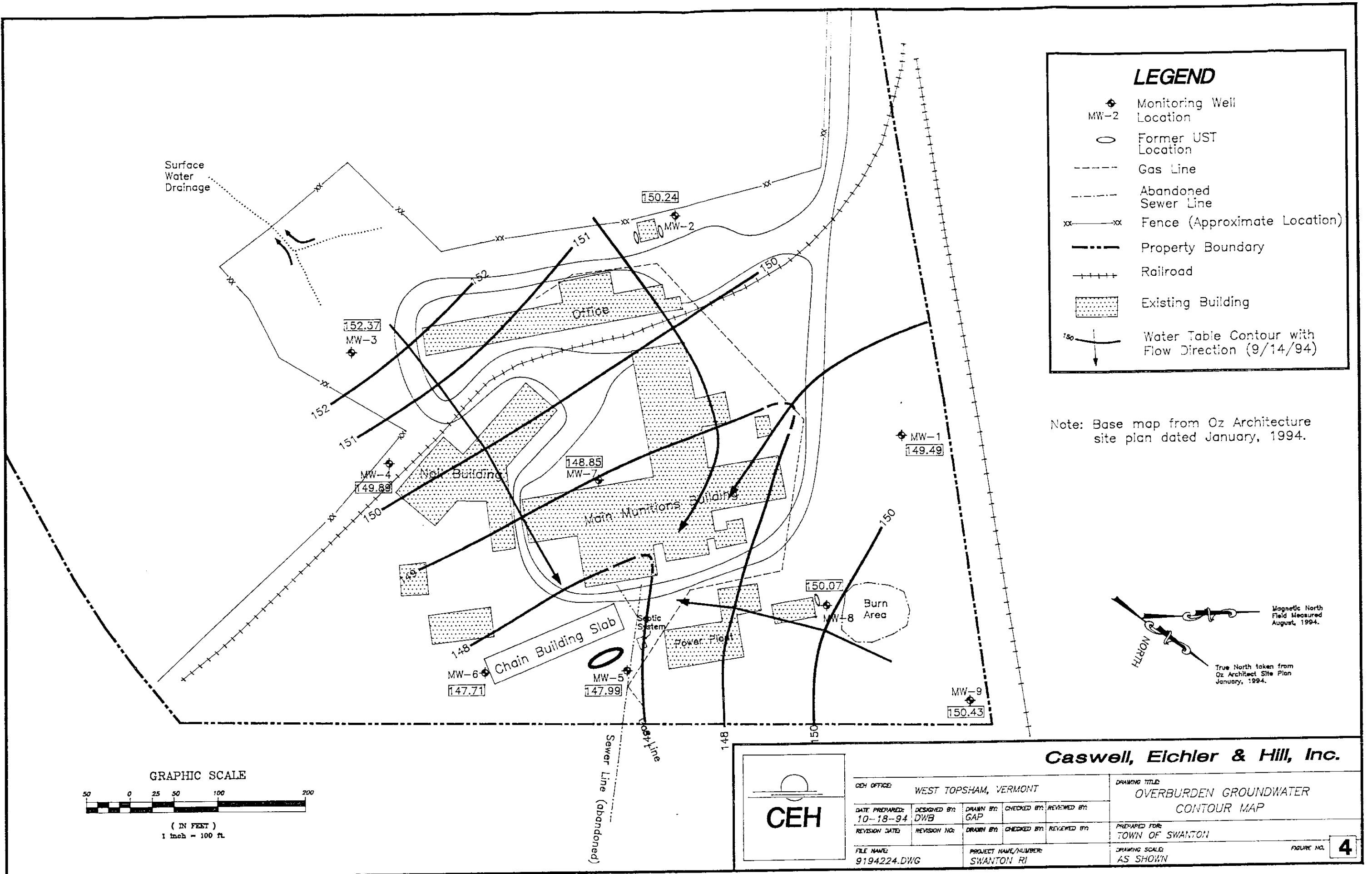
LOCATION OF TEST PITS IN CHAIN BUILDING LEACHING FIELD

PREPARED FOR: TOWN OF SWANTON

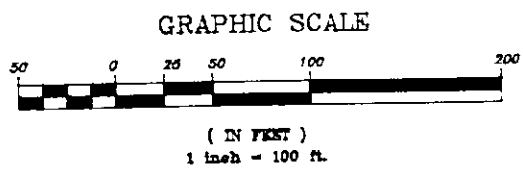
DRAWING SCALE: 1"=10'

FIGURE NO:

3



Surface
Water
Drainage



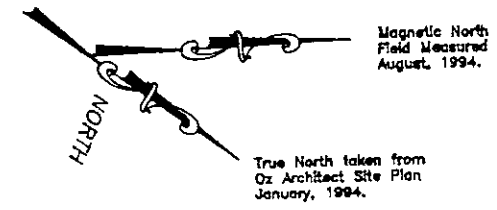
Sewer Line (abandoned)

LEGEND

- ◆ MW-2 Monitoring Well Location
- Former UST Location
- - - Gas Line
- - - Abandoned Sewer Line
- xx - - - Fence (Approximate Location)
- - - Property Boundary
- ++++ Railroad
- Existing Building
- Sample Points
Value denotes concentration of Lead in Soil (mg/kg)
- Sample Points taken by Aquatic on 8/9/91

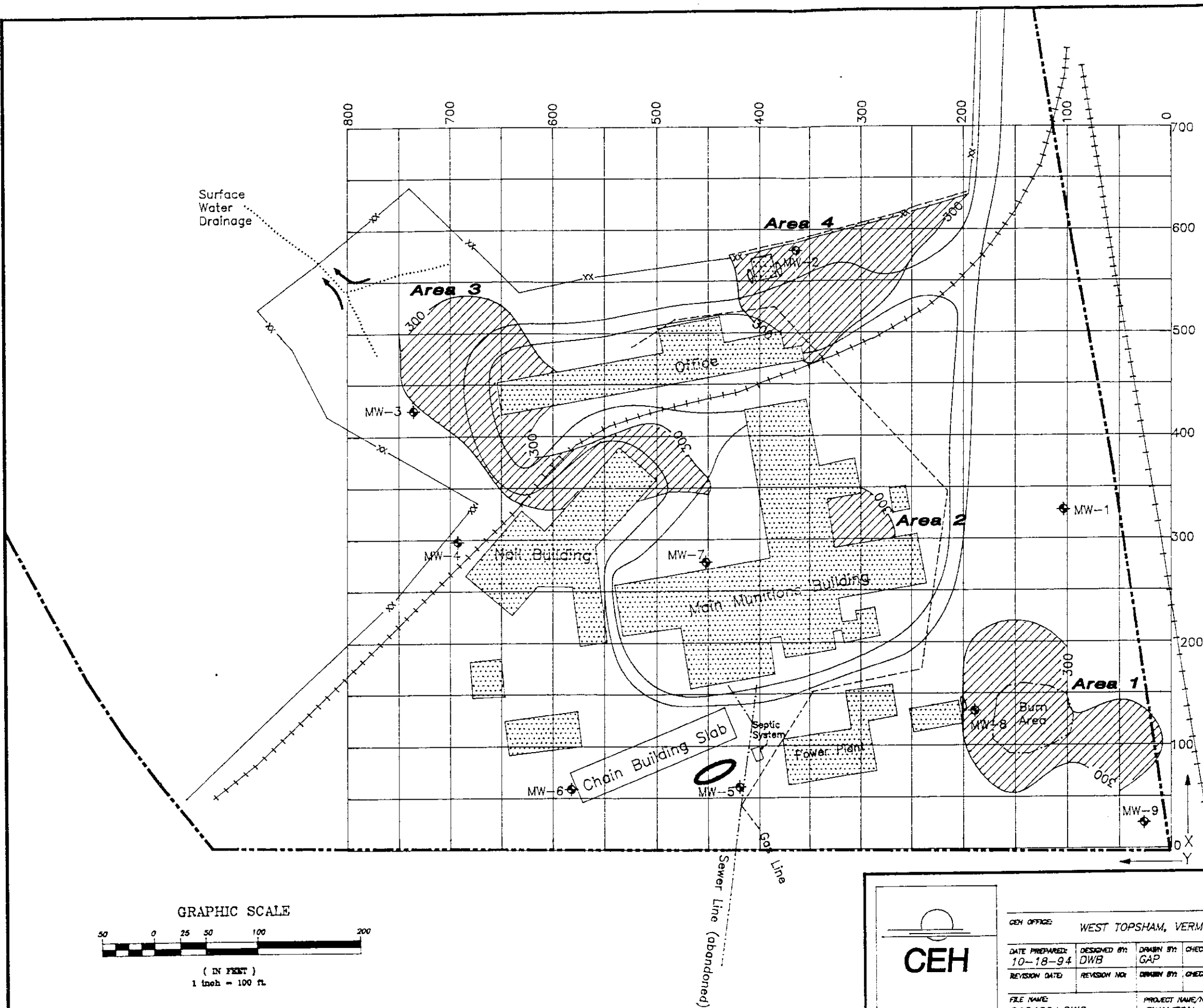
Note: Base map from Oz Architecture site plan dated January, 1994.

Location of sampling grid is approximate and is not surveyed.



Caswell, Eichler & Hill, Inc.

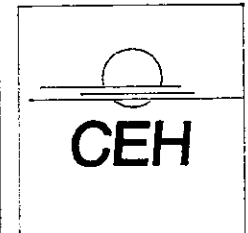
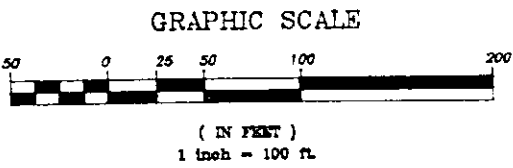
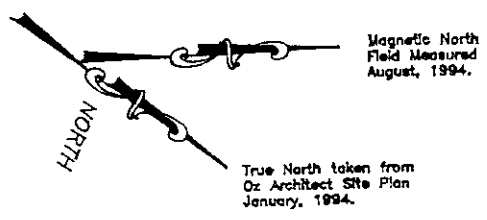
CEH OFFICE: WEST TOPSHAM, VERMONT					DRAWING TITLE	
DATE PREPARED: 10-18-94					SURFICIAL SOIL SAMPLE LOCATIONS WITH LEAD CONCENTRATIONS	
DESIGNED BY: DWB					PREPARED FOR:	
DRAWN BY: GAP					TOWN OF SWANTON	
CHECKED BY:					DRAWING SCALE:	
REVIEWED BY:					AS SHOWN	
FILE NAME: 9194224.DWG					PROJECT NAME/NUMBER:	
					SWANTON RI	



LEGEND

- MW-2 Monitoring Well Location
- Former UST Location
- - - Gas Line
- - - Abandoned Sewer Line
- xx-xx Fence (Approximate Location)
- - - Property Boundary
- ++++ Railroad
- [Stippled Area] Existing Building
- [Shaded Area] Lead Concentrations in soil (Exceeding Cleanup Goal of 300ppm or greater)

Note: Base map from Oz Architecture site plan dated January, 1994.
 Location of sampling grid is approximate and is not surveyed.



Caswell, Eichler & Hill, Inc.

CEH OFFICE: WEST TOPSHAM, VERMONT				DRAWING TITLE:	
DATE PREPARED: 10-18-94				LEAD CONCENTRATIONS IN SURFICIAL SOIL EXCEEDING CLEANUP GOAL	
DESIGNED BY: DHB				PREPARED FOR:	
DRAWN BY: GAP				TOWN OF SWANTON	
CHECKED BY: [blank]				DRAWING SCALE:	
REVISION NO.:				AS SHOWN	
FILE NAME: 9:94224.DWG				PROJECT NAME/NUMBER:	
				SWANTON RI	

APPENDIX A
CHAIN BUILDING LEACHING FIELD TEST PIT LOGS

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVEL

TEST PIT NO.: STEP-1

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: 1045

FILE NO.: _____

OPERATOR: DPW

TIME COMPLETED: 1115

CEH REP.: D. CHAPMAN

MAKE: CASE MODEL: 5806

GROUND ELEV.: _____

WEATHER: FAIR 65°

CAPACITY: 4 YD REACH: 9'

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	SAND	DARK BROWN FINE SAND	EASY	
-2--		RED BROWN TO YELLOW BROWN FINE SAND		
-3--		GRAY BROWN FINE SAND		
-4--				
-5--		GRAY BROWN MEDIUM SAND		
-6--		BOTTOM OF TEST PIT @ 6' BGS		
-7--				
-8--				
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

TEST PIT IS ALONG THE NORTH SIDE OF THE CHAIN BUILDING SEPTIC TANK

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG	
------------------------------	--

PROJECT: SWANTON RI/REDEV

TEST PIT NO.: ST TP-2

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: 115

FILE NO.:

OPERATOR: DPW

TIME COMPLETED: 1145

CEH REP.: D. CHAPMAN

MAKE: CASE MODEL: 5806

GROUND ELEV.: _____

WEATHER: Fair 65°

CAPACITY: 1/4 Yp REACH: 9'

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	SAND	DARK BROWN FINE SAND	EASY	
-2--		RED BROWN AND YELLOW BROWN FINE SAND		
-3--		GRAY BROWN FINE SAND		
-4--				
-5--		GRAY BROWN MEDIUM SAND		
-6--		BOTTOM OF TEST PIT @ 6' BGS		
-7--				
-8--				
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

CHAMBERS

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVELTEST PIT NO.: ST TP-3LOCATION: ROBIN HOOD AMMUNITION WORKSDATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTONTIME STARTED: 1310OPERATOR: DPWTIME COMPLETED: 1340MAKE: CASE MODEL: 580K

GROUND ELEV.: _____

CAPACITY: 1/4 YD REACH: 9'

FILE NO.: _____

CEH REP.: D. CHAPMANWEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	Fill	BROWN FINE TO COARSE SAND	EASY	WOODEN PIPE EXPOSED @ 5' BGS. APPARENTLY THIS IS AN OLD SEWER LINE TO THE BROOK LOCATED TO THE EAST. ALSO EXPOSED A PERFORATED WHITE PVC PIPE ORIENTED FROM NW TO SE.
-2--				
-3--				
-4--	SAND	GRAY - BROWN FINE SAND		
-5--				
-6--		BOTTOM OF TEST PIT @ 5.5'	BGS	
-7--				
-8--				
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

RE
M
A
R
K
S

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVTEST PIT NO.: ST TP-4LOCATION: ROBIN HOOD AMMUNITION WORKSDATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTONTIME STARTED: 1340OPERATOR: DPWTIME COMPLETED: 1400MAKE: CASE MODEL: 580K

GROUND ELEV.: _____

CAPACITY: 1/4 YD REACH: 9'

FILE NO.: _____

CEH REP.: D. CHAPMANWEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
0.2				
0.5				
1.3	FILL	BLACK ASH GRAY MEDIUM SAND DARK BROWN FINE SAND		
-2--		GRAY BROWN FINE SAND		
-3--	SAND		EASY	ORANGE STAINING ON SIDEWALL @ 2.10' BGS AND 5.4' BGS TO THE BOTTOM OF THE PIT. ORANGE GROUNDWATER OBSERVED.
-4--		GRAY BROWN MEDIUM SAND		
-5--				
-6--				
-7--		BOTTOM OF PIT @ 6.0' BGS		
-8--				
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVEL

LOCATION: ROBIN HOOD AMMUNITION WORKS

TEST PIT NO.: ST TP-5

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

OPERATOR: DPW

MAKE: CASE MODEL: 580K

CAPACITY: 1/4 YD REACH: 9'

TIME STARTED: 1400

TIME COMPLETED: 1615

GROUND ELEV.: _____

FILE NO.: _____

CEH REP.: D. CHAPMAN

WEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	SAND	DARK BROWN FINE SAND	EASY	
-2--		BROWN FINE SAND		
-3--		MOTTLED RED BROWN/GRAY		
-4--				
-5--		BROWN MEDIUM SAND		
-6--		MOTTLED RED BROWN/GRAY		
-7--		BOTTOM OF TEST PIT @ 6.5' BGS		
-8--				
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEV

TEST PIT NO.: ST TP-7

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: 1530

OPERATOR: DPW

TIME COMPLETED: 1530

MAKE: CASE MODEL: 580K

GROUND ELEV.:

CAPACITY: 1/4 YD REACH: 9'

FILE NO.:

CEH REP.: D. CHAPMAN

WEATHER: FAIR, 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
0.7		DARK BROWN FINE SAND		
1.3		ORANGE BROWN FINE SAND		
		YELLOW-BROWN FINE SAND		
2.2	SAND	GRAY BROWN FINE SAND	EASY	MOTILING @ 1.5' BGS ORANGE GROUND WATER @ 5.7' BGS
5.8		BOTTOM OF TEST PIT @ 5.8' BGS		

REMARKS

APPENDIX B
MONITORING WELL TEST PIT LOGS

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEV

TEST PIT NO.: MW-1

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: 0715

OPERATOR: DPW

TIME COMPLETED: 0745

MAKE: CASE MODEL: 580K

GROUND ELEV.: 153.9

CAPACITY: 1/4 YD REACH: 9'

FILE NO.: _____

CEH REP.: D. CHAPMAN

WEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	8" TOPSOIL	DARK BROWN FINE SAND	EASY	2" Ø PVC WELL INSTALLED: SCREENED FROM 3'-8' BGS. RISER FROM 3' BGS TO 1.1' AGS. SLIP-ON BOTTOM CAP, LOCKING, EX- PANSION-TYPE TOP CAP.
-2--	24" SAND	RED BROWN TO YELLOW BROWN FINE SAND		
-3--		GRAY BROWN FINE SAND		
-4--	48" SAND	GRAY BROWN FINE TO MED. SAND		
-5--				
-6--	SILTY FINE SAND	GRAY BROWN SILTY FINE SAND		
-7--				
-8--		BOTTOM OF TEST PIT @ 8' BGS		
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVELTEST PIT NO.: MW-2LOCATION: ROBIN HOOD AMMUNITION WORKSDATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTONTIME STARTED: 0800

OPERATOR: _____

TIME COMPLETED: 0830MAKE: CASE MODEL: 580KGROUND ELEV.: 153.3CAPACITY: 1/4 YD. REACH: 9'

FILE NO.: _____

CEH REP.: D. CHAPMANWEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
0.5 -1--	SILTY SAND	DK BRN SILTY F-M SAND	EASY	2" Ø PVC WELL INSTALLED. SCREENED FROM 2.4 TO 7.4 FEET BGS. RISER FROM 2.4 FEET BGS TO 1.0 FOOT AGS. SLIP ON BOTTOM CAP. LOCKING, EXPANSION- TYPE TOP CAP.
-2--		GRAY BROWN SILTY FINE TO MEDIUM SAND		
-3--				
-4--				
-5--				
-6--				
-7--				
7.4 -8--		BOTTOM OF TEST PIT @ 7.4' BGS		
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEV

TEST PIT NO.: HW-3

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: _____

OPERATOR: DPW

TIME COMPLETED: _____

MAKE: CASE MODEL: 580K

GROUND ELEV.: 150.6

CAPACITY: 1/4 YD REACH: 9'

FILE NO.: _____

CEH REP.: D. CHAPMAN

WEATHER: FAIR GS

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
1.5 -1--	SILTY FINE SAND	DARK BROWN SILTY FINE SAND	EASY	2" DIAM PVC WELL INSTALLED. SCREENED FROM 1.1' BGS TO 6.1' BGS. RISER FROM 1.1' BGS TO 1 FOOT AGS. SLIP ON BOTTOM CAP. LOCKING EXPANSION-TYPE TOP CAP.
-2--		GRAY BROWN SILTY FINE SAND		
-3--				
-4--				
-5--				
6.1 -6--		BOTTOM OF PIT @ 6.1' BGS		
-7--				
-8--				
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI / REDEV

TEST PIT NO.: MW-4

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: _____

FILE NO.: _____

OPERATOR: DPW

TIME COMPLETED: _____

CEH REP.: D. CHAPMAN

MAKE: CASE MODEL: 580K

GROUND ELEV.: 152.4

WEATHER: FAIR 65°

CAPACITY: 1/4 Yd. REACH: 9'

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
1.0		PARK BROWN FINE SAND		
1.5		RED BROWN FINE SAND		
2.0				
3.0	SAND	GRAY BROWN FINE SAND	EASY	2" PVC WEL
4.0				INSTALLED. SCREENED
5.0				FROM 3.1 TO 8.1' BGS
6.0				RISER FROM 3.1' BGS
7.0				TO 1.5' AGS. SLIP
8.0				ON BOTTOM CAP. LOOKING
8.1				EXPANSION-TYPE
9.0				TOP CAP.
10.0				
11.0				
12.0				
13.0				
14.0				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVEL
 LOCATION: ROBIN HOOD AMMUNITION WORKS

STEP-6
 TEST PIT NO.: MW-5
 DATE: 8/7/94

EXCAVATION EQUIPMENT
 CONTRACTOR: TOWN OF SWANTON
 OPERATOR: DPW
 MAKE: CASE MODEL: 580K
 CAPACITY: 1/4 YD REACH: 9'

TIME STARTED: 1415
 TIME COMPLETED: 1500
 GROUND ELEV.: 154.3

FILE NO.: _____
 CEH REP.: D. CHAPMAN
 WEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	FILL - SEPTIC SYSTEM	BROWN FINE-COARSE SAND	EASV	2" Ø PVC WELL INSTALLED. SCREENED FROM 3.3 FEET TO 8.3 FEET BGS. RISER FROM 3.3' BGS TO 1.0' AGS. SLIP-ON TYPE BOTTOM CAP. LOCKING EXPANSION- TYPE TOP CAP
-2--		GRAY 3/4" STONE		
-3--				
-4--	SAND	GRAY BROWN FINE SAND		
-5--				
-6--				
-7--				
-8--				
-9--		BOTTOM OF TEST PIT @ 8.3' BGS		PERFORATED WHITE PVC LEACHFIELD PIPE WAS EXPOSED PARALLEL TO WEST SIDEWALL OF PIT.
-10--				ORANGE STAINING NOTED @ 5' BGS.
-11--				
-12--				
-13--				
-14--				

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CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVEL
 LOCATION: ROBIN HOOD AMMUNITION WORKS

TEST PIT NO.: MW-6

DATE: 8/17/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON
 OPERATOR: DPW
 MAKE: CASE MODEL: 580k
 CAPACITY: 1/4 YD REACH: 9'

TIME STARTED: 1550
 TIME COMPLETED: 1630
 GROUND ELEV.: 154.3

FILE NO.: _____

CEH REP.: D. CHAPMAN

WEATHER: FAIR 65°

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1-- 1.5	FILL	BLACK ASH	EASY	2" Ø PVC WELL INSTALLED. SCREENED FROM 3.3' TO 8.3' BGS. RISER FROM 3.3' BGS TO 1.4' AGS. SLIP-ON BOTTOM CAP. LOCKING, 8" X PAN- SIDE-TYPE TOP CAP.
-1.0		DARK BROWN FINE SAND		
-2--		RED BROWN TO YELLOW BROWN FINE SAND		
-3-- 2.5		GRAY BROWN FINE SAND		
-4--	SAND			
-5--				
-6--				
-7--				
-8--				
-9--		BOTTOM OF TEST PIT @ 8.3' BGS		
-10--				
-11--				
-12--				
-13--				
-14--				

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(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVELLOCATION: ROBIN HOOD AMMUNITION WORKSTEST PIT NO.: MW-7DATE: 8/18/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTONOPERATOR: DPLWMAKE: CASE MODEL: 480CAPACITY: 1/4 YD REACH: 9'TIME STARTED: 0700TIME COMPLETED: 0745GROUND ELEV.: 154.4

FILE NO.: _____

CEH REP.: D. BROOKSWEATHER: RAIN 70S

SAMPLE DEPTH FEET	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
-1--	SAND	DARK BROWN SILTY FINE SAND	EASY	2" PVC WELL INSTALLED. SCREENED FROM 2.5' TO 7.5' BGS. RISER FROM 2.5' BGS TO 1' AGS. SLIP ON BOTTOM CAP. LOCKING EXPAN- SION-TYPE TOP CAP.
-2--		REDDISH BROWN FINE SAND		
-3--		LIGHT BROWN FINE SAND		
-4--				
-5--				
-6--				
-7--				
-8--		BOTTOM OF TEST PIT AT 7.5'	BGS	
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI / REDEVEL

TEST PIT NO.: MW-8

LOCATION: ROBIN HOOD AMMUNITION WORKS

DATE: 8/18/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTON

TIME STARTED: 0745

OPERATOR: DRW

TIME COMPLETED: 0830

MAKE: CASE MODEL: 480

GROUND ELEV.: 153.1

CAPACITY: 1/4 YD REACH: 9'

FILE NO.: _____

CEH REP.: D. BROOKS

WEATHER: RAIN 70S

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--	SAND	BLACK M.C SAND LIKE ASH	EASY	2" Ø PVC WELL INSTALLED. SCREENED FROM 2.2' TO 7.2' BGS. RISER FROM 2.2' BGS TO 1' AGS. SLIP ON TYPE BOTTOM CAP. LOCKING EXPANSION-TYPE TOP CAP
-2--		TAN TO ORANGE MEDIUM SAND		
-3--				
-4--		GRAY MEDIUM SAND		
-5--				
-6--				
-7--				
-8--		BOTTOM OF TEST PIT AT 7.2'	BGS	
-9--				
-10--				
-11--				
-12--				
-13--				
-14--				

REMARKS

(3141)

CEH, TEST PIT EXCAVATION LOG

PROJECT: SWANTON RI/REDEVTEST PIT NO.: MW-9LOCATION: ROBIN HOOD AMMUNITION WORKSDATE: 8/18/94

EXCAVATION EQUIPMENT

CONTRACTOR: TOWN OF SWANTONTIME STARTED: 0830OPERATOR: DPWTIME COMPLETED: 0915MAKE: CASE MODEL: 480GROUND ELEV.: 152.8CAPACITY: 4 YD REACH: 9'

FILE NO.: _____

CEH REP.: D. BROOKSWEATHER: RAIN 70s

SAMPLE DEPTH	STRATA CHANGE	SOIL DESCRIPTION	EXCAV. EFFORT	REMARKS
FEET				
-1--		BLACK, ORGANIC TOPSOIL		2" Ø PVC WELL
-2--				INSTALLED, SCREENED
-3--		ASH, RED BRICK-COLORED	EASY	FROM 2.7' TO 7.7'
-4--		TAN FINE SAND AND SILT		BGS. RISER FROM
-5--		GRAY FINE SAND		2.7' BGS TO 0.4'
-6--				AGS. SHIP ON BOTTOM
-7--				CAP. LOCKING EX-
-8--				PANSION-TYPE TOP
-9--				CAP.
-10--				
-11--				
-12--				
-13--				
-14--				
7.7		BOTTOM OF TEST PIT AT 7.7'	BGS	

REMARKS

APPENDIX C
LABORATORY RESULTS



IEA

An Aquarion Company

149 Rangeway Road
North Billerica, MA 01862

Phone 617-272-5212
Fax 508-667-7871

Mr. David Brooks
Caswell, Eichler, & Hill, Inc.
P. O. Box 5247
Augusta, ME 04330

October 3, 1994

Dear Mr. Brooks:

Please find enclosed the analytical results of the sample(s) received at our laboratory on September 17, 1994. This report contains sections addressing the following information at a minimum:

- analytical results
- chain-of-custody (if applicable)

Client Project #	6094035	Client Project Name	N/A
IEA Report #	C126-002	Purchase Order #	N/A

Copies of this analytical report and supporting data are maintained in our files for a minimum of 3 years unless special arrangements are made. Unless specifically indicated, all analytical testing was performed at the IEA-Massachusetts laboratory.

We appreciate your selection of our services and welcome any questions or suggestions you may have relative to this report. Please contact your customer service representative at (617) 272-5212 for any additional information. Thank you for utilizing our services and we hope you will consider us for your future analytical needs.

I have reviewed and approved the enclosed data for final release.

Sincerely,

Michael F. Wheeler, Ph.D.
Laboratory Director
IEA-Massachusetts

MW/slh

DOC# RPF00300.MA

Monroe,
Connecticut
203-261-4458

Sunrise,
Florida
305-846-1730

Schaumburg,
Illinois
708-705-0740

Whippany,
New Jersey
201-428-8181

Research Triangle Park,
North Carolina
919-677-0090

IEA LABORATORY RESULTS

Report Date: 09/30/94
Client: Caswell, Eichler, & Hill, Inc.
Project: 6094035

Received Date: 09/17/94
IEA Job Number: C126-002

IEA Sample #	Client ID	Parameter	Results	Units	PQL	Date Analyzed
=====						
1	MW-1	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
2	MW-2	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
3	MW-3	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
4	MW-4	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
5	MW-5	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
6	MW-6	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
7	MW-7	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
8	MW-8	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
9	MW-9	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94
10	MW-19	TOTAL METALS Lead	BQL	mg/L	0.0050	09/26/94





IEA

An Aquarion Company

IEA LABORATORY RESULTS

Report Date: 09/30/94
Client: Caswell, Eichler, & Hill, Inc.
Project: 6094035

Received Date: 09/17/94
IEA Job Number: C126-002

IEA Sample #	Client ID	Parameter	Results	Units	PQL	Date Analyzed
11	SS-200, 50	TOTAL METALS Lead	84	mg/kg (dry)	10	09/28/94
12	SS-200, 150	TOTAL METALS Lead	3,410	mg/kg (dry)	10	09/28/94
13	SS-550, 650	TOTAL METALS Lead	139	mg/kg (dry)	10	09/28/94
14	SS-550, 750	TOTAL METALS Lead	192	mg/kg (dry)	10	09/28/94

COMMENTS:

PQL = Practical Quantitation Limit
BQL = Below Quantitation Limit

Result3.wk1 Rev. 041393



IEA

An Aquarion Company

Analysis Report: EPA Method 624
(PAGE 1 OF 2 PAGES)

Client: Caswell, Etchler, & Hill, Inc. IEA ID: C126-002-05
Project: 6094035 Sample: MW-5
Report Date: 09/30/94 Type: Water
Collected: 09/15/94 Container: VOA
Received: 09/17/94
Analyzed: 09/23/94
By: LSB Dilution Factor: 1

Priority Pollutant Compounds

Number	Compound	PQL (ug/L)	Result (ug/L)
1	Benzene	5	BQL
2	Bromodichloromethane	5	BQL
3	Bromoform	5	BQL
4	Bromomethane	10	BQL
5	Carbon tetrachloride	5	BQL
6	Chlorobenzene	5	BQL
7	Chloroethane	10	BQL
8	2-Chloroethylvinyl ether	5	BQL
9	Chloroform	5	BQL
10	Chloromethane	10	BQL
11	Dibromochloromethane	5	BQL
12	1,2-Dichlorobenzene	5	BQL
13	1,3-Dichlorobenzene	5	BQL
14	1,4-Dichlorobenzene	5	BQL
15	1,1-Dichloroethane	5	BQL
16	1,2-Dichloroethane	5	BQL
17	1,1-Dichloroethene	5	BQL
18	1,2-Dichloroethenes (Total) #	5	BQL
19	1,2-Dichloropropane	5	BQL
20	cis-1,3-Dichloropropene	5	BQL
21	trans-1,3-Dichloropropene	5	BQL
22	Ethylbenzene	5	BQL
23	Methylene chloride	5	BQL
24	1,1,2,2-Tetrachloroethane	5	BQL
25	Tetrachloroethene	5	BQL
26	Toluene	5	BQL
27	1,1,1-Trichloroethane	5	BQL
28	1,1,2-Trichloroethane	5	BQL
29	Trichloroethene	5	BQL
30	Trichlorofluoromethane	5	BQL
31	Vinyl chloride	10	BQL

Doc# MSF10100.MA





IEA

An Aquarion Company

Analysis Report: EPA Method 624
(PAGE 2 OF 2 PAGES)

Client: Caswell, Etchler, & Hill, Inc. IEA ID: C126-002-05
Project: 6094035 Sample: MW-5

Other TCL Compounds *

Number	Compound	PQL (ug/L)	Result (ug/L)
32	Acetone	100	580
33	2-Butanone	100	200
34	Carbon disulfide	5	BQL
35	1,2-Dibromoethane	5	BQL
36	2-Hexanone	50	BQL
37	4-Methyl-2-pentanone	50	BQL
38	Methyl-t-butyl ether	5	BQL
39	Styrene	5	BQL
40	Vinyl acetate	50	BQL
41	Xylenes (Total)	5	BQL

Surrogate Standard Recovery:

1,2-Dichloroethane-d4	92 %
Toluene-d8	95 %
Bromofluorobenzene	82 %

Comments:

- BQL = Below Quantitation Limit.
PQL = Practical Quantitation Limit.
- * EPA Method 624 does not specify other TCL compounds. Analysis and QC requirements for these parameters are laboratory derived.
 - # EPA Method 624 specifies trans-1,2-dichloroethene as a priority pollutant compound. Analysis and QC for total-1,2-dichloroethenes is based on the method requirements for the trans isomer.

Doc# MSF10100.MA



IEA

An Aquarion Company

Analysis Report: EPA Method 624
(PAGE 1 OF 2 PAGES)

Client: Caswell, Etchler, & Hill, Inc. IEA ID: C126-002-08
Project: 6094035 Sample: MW-8
Report Date: 09/30/94 Type: Water
Collected: 09/15/94 Container: VOA
Received: 09/17/94
Analyzed: 09/23/94
By: LSB Dilution Factor: 1

Priority Pollutant Compounds

Number	Compound	PQL (ug/L)	Result (ug/L)
1	Benzene	5	BQL
2	Bromodichloromethane	5	BQL
3	Bromoform	5	BQL
4	Bromomethane	10	BQL
5	Carbon tetrachloride	5	BQL
6	Chlorobenzene	5	BQL
7	Chloroethane	10	BQL
8	2-Chloroethylvinyl ether	5	BQL
9	Chloroform	5	BQL
10	Chloromethane	10	BQL
11	Dibromochloromethane	5	BQL
12	1,2-Dichlorobenzene	5	BQL
13	1,3-Dichlorobenzene	5	BQL
14	1,4-Dichlorobenzene	5	BQL
15	1,1-Dichloroethane	5	BQL
16	1,2-Dichloroethane	5	BQL
17	1,1-Dichloroethene	5	BQL
18	1,2-Dichloroethenes (Total) #	5	BQL
19	1,2-Dichloropropane	5	BQL
20	cis-1,3-Dichloropropene	5	BQL
21	trans-1,3-Dichloropropene	5	BQL
22	Ethylbenzene	5	BQL
23	Methylene chloride	5	BQL
24	1,1,2,2-Tetrachloroethane	5	BQL
25	Tetrachloroethene	5	BQL
26	Toluene	5	BQL
27	1,1,1-Trichloroethane	5	BQL
28	1,1,2-Trichloroethane	5	BQL
29	Trichloroethene	5	BQL
30	Trichlorofluoromethane	5	BQL
31	Vinyl chloride	10	BQL

Doc# MSF10100.MA



IEA

An Aquarion Company

Analysis Report: EPA Method 624
(PAGE 2 OF 2 PAGES)

Client: Caswell, Etchler, & Hill, Inc. IEA ID: C126-002-08
Project: 6094035 Sample: MW-8

Other TCL Compounds *

Number	Compound	PQL (ug/L)	Result (ug/L)
32	Acetone	100	BQL
33	2-Butanone	100	BQL
34	Carbon disulfide	5	BQL
35	1,2-Dibromoethane	5	BQL
36	2-Hexanone	50	BQL
37	4-Methyl-2-pentanone	50	BQL
38	Methyl-t-butyl ether	5	BQL
39	Styrene	5	BQL
40	Vinyl acetate	50	BQL
41	Xylenes (Total)	5	BQL

Surrogate Standard Recovery:

1,2-Dichloroethane-d4	103 %
Toluene-d8	100 %
Bromofluorobenzene	95 %

Comments:

- BQL = Below Quantitation Limit.
PQL = Practical Quantitation Limit.
- * EPA Method 624 does not specify other TCL compounds. Analysis and QC requirements for these parameters are laboratory derived.
 - # EPA Method 624 specifies trans-1,2-dichloroethene as a priority pollutant compound. Analysis and QC for total-1,2-dichloroethenes is based on the method requirements for the trans isomer.

Doc# MSF10100.MA